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ABSTRACT

Forty reflective and 40 impulsive children were assigned to one of four treatment conditions. The learning task employed a list of 25 familiar objects, five instances from each of five categories. The four treatments were Randomized-No Instructions, Randomized-Instructed, Blocked-No Instructions, and Blocked-Instructed. Results support earlier findings that retention and clustering are facilitated by a blocking technique. Clustering was also improved by instructions. For free recall however, instructions aided impulsives but hampered recall for reflectives. This suggests the use of different organizational strategies by people differing in cognitive tempos. Free recall was no better when instructions were given than when they were omitted; however, cued recall was facilitated by instructions. Support for a retrieval deficit hypothesis is indicated. (Author)

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TASK STRUCTURE AND COGNITIVE TEMPO

INFLUENCE ON ORGANIZATIONAL MEMORY IN CHILDREN

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TASK STRUCTURE AND COGNITIVE TEMPO:

INFLUENCE ON ORGANIZATIONAL MEMORY IN CHILDREN

The numerous ways people approach new material to be learned are of educational significance. For example, differences in the amount of retention and clustering of materials presented in the course of learning may be greatly influenced by individual differences among learners (e.g. Frederiksen and Rohwer, 1974). The various modes of perceiving, memorizing, organizing, and utilizing the stimuli presented, a few of the aspects of cognitive ability assumedly determine the differential effectiveness of educational or learning situations. Specific dispositions or cognitive strategies may interact with the variables manipulated by the experimenter. That is, the varying treatment conditions possibly have differing effects depending upon cognitive tendencies of the subject. One such disposition (reflection-impulsivity) is the individual's tendency to either reflect on his cognitive products and their quality or to impulsively answer and accept an early response. Research investigating this cognitive dimension has focused on the dimensions speed of response and error rate in situations involving high response uncertainty.

As an individual perceives and responds to stimuli presented in the course of learning, organization of stimuli in memory occurs to allow for retrieval of the material on a later occasion. Regardless of when organization occurs, during storage or at time of retrieval (Postman, 1972), a variety of strategies used during this organization may develop. A person can associate new material with older, previously stored material, or create a mental image of the new learning materials. It may be possible to categorize the information on the basis of one or more common attributes and subsume items under one classification (hierarchical organization). The

efficiency of the search procedure and subsequent retrieval from memory is largely dependent upon how well material has been organized (Kintsch, 1972). Inadequate organization and storage procedures may not be the sole contributors to poor recall. A retrieval deficit hypothesis (Eysenck and Baror, 1974) would suggest that there is primarily a problem in getting items out of storage. Cuing a person at time of recall should alleviate this retrieval deficit to a great extent and allow for better performance than in a situation of free recall.

In studies concerned with visual scanning strategies, data have shown (Lee, Kagan, and Rabson, 1963) that reflective individuals are predisposed to search for subelements within a stimulus situation. They split up the total situation analytically when asked to look for similarity between objects within larger contexts. These analytic responses were found to be associated with longer response times (Kagan, Moss, and Sigel, 1963). Impulsives have been found, generally, to ignore more alternatives and to look more globally at the standard (Kagan, Pearson, & Welch, 1966; Sigelman, 1969; Drake, 1970). Drake (1970) has demonstrated that reflectives frequently rechecked all alternatives and devoted proportionately less time to the standard than impulsives because of their tendency to be more analytic.

It was felt that this dimension of cognitive tempo may transfer as a relevant factor and account for differences found in hierarchical memory organization. Previous studies (Moely, Olson, Hawles, and Flavell, 1969; Nelson, 1969; Kobasigaw and Middleton, 1972; Schultz, Charness, and Berman, 1973) have included conditions of training, which were found to enhance recall. Teaching category labels, naming items that 'go together' as they were presented, physical sorting of items into groups and simple suggestions that items may be organized were some of the ways in which training occurred.

Most studies, however, have ignored the cognitive tempos of the subjects. Categorizable lists have been shown to be better remembered than uncategorizable lists and that blocking with instructions is more advantageous than random presentation without instructions (Laurence, 1967). An analytical cognitive approach may elicit increased labeling or categorizing of the to-be-learned material and enhance clustering and retention. A study in which categorized organizational ability is induced through presenting categorizable items in a blocked or random manner with or without instructions, may produce differences accountable in part by cognitive tempo.

In tasks typically used to measure reflection-impulsivity (Kagan, 1965), there are a number of very similar response alternatives to a specific stimulus or standard, with the correct choice being the alternative that is exactly like the standard. A negative correlation (averaging .4) has been found between response time and the number of errors (Kagan, 1965; Kagan, 1966; Kagan, et al., 1966; Block, Block, and Harrington, 1974). Impulsive individuals are those who show shorter response latencies accompanied by more mistakes, possibly acting upon the first hypothesis generated, while reflectives display opposite tendencies, taking more time to analyze the situation before responding, thus reducing errors. In any sample, those scoring above the sample median on errors and below the median on response latency are defined as impulsive while those individuals scoring below the median on errors and above the response latency median are defined as reflective.

The present study concerned itself with the question of cognitive tempo and the structure of a memory task as it relates to recall as well as to the clustering (hierarchical organization) of items. Reflective children were expected to perform better on recall and clustering than impulsives when

presented with a partially structured situation, that is, when categorizable items were shown under conditions varying in the extent of structure (random or blocked presentation) and in the inclusion or exclusion of instructions concerning the list's categorizability and its usefulness in recall. It was felt that their analytical style might allow them to impose greater structure on the material, leading to better organization thus enhancing recall. With minimal structure, no blocking or instructions, subjects who were impulsives would not display the organizational ability of reflectives. With additional structure, impulsives should increase their level of clustering and the amount recalled.

METHOD

Subjects. Ninety-seven subjects were obtained from the fourth and fifth grade classes at the Madrid, Iowa, Public School. From this pool of potential subjects, eighty were selected for the experiment on the basis of scores on the Matching Familiar Figures test. Forty children scoring above the median on latency (12.5 seconds) as well as below the median on errors for the group (7.5 errors) were classified as reflective. Forty subjects scoring below the median on latency and above the median on errors were classified as reflectives. The correlation between errors and latency for both groups was -.59. Sixteen males and twenty-four females were classified as reflectives while nineteen males and twenty-one females were classified impulsives.

Materials. The stimuli used in the learning task were a single list of 25 familiar objects presented on a screen via a projector. Five instances from each of five categories were presented once to each subject in the form of pictures of black and white drawings. The superordinate categories were vehicles, clothing, furniture, animals, and body parts. The list

contained pictures of a car, train, bus, truck, wagon, tie, hat, mitten, shoe, dress, table, chair, lamp, couch, bed, horse, kitten, lion, elephant, cow, lips, eye, arm, foot, and hand. Presentation interval was self-paced with subjects naming each picture as it was presented.

Procedure. Following the classification procedure, subjects were randomly assigned to one of four treatment conditions with 10 reflectives and 10 impulsives in each. The four treatment conditions were as follows: Randomized-No instruction (RNI), the stimuli were shown in a random order, with no two items from the same category appearing consecutively and no instructions concerning the nature of the list (its categorizability) were given. Randomized-Instructed (RI), consisted of random list presentation with instructions given to the subjects informing them that the list would be composed of items that could be categorized and that recall could be facilitated by remembering the items that are alike. Blocked-No Instructions (BNI), the list of items were arranged so that all instances of each category appeared consecutively with no instructions included. Blocked-Instructed (BI), the items were presented as in BNI, and instructions as in RI were supplied. The RNI condition was considered the treatment condition with the least structure while the BI condition was felt to possess the greatest amount of structure.

Immediately following a single presentation of the list, subjects were asked to recall as many items as possible. A cued recall procedure followed free recall in which the superordinate category lables were presented verbally and subjects were asked to name as many items as possible ("Do you remember any animals?"). Labels were presented in a random order to each subject. Cued recall was included in order to determine the extent to which category labels were available to subjects and used during retrieval to improve recall

performance. Two recall scores, free and cued, were obtained from each subject as was an index of clustering based on the free recall performance. Total viewing time for the 25 item list and total time for free recall were obtained for each subject.

RESULTS

A clustering measure, the adjusted ratio of clustering (ARC), developed by Roenker, Thompson, and Brown (1971), was employed. Clustering scores were analyzed using a 2 (cognitive tempo) X 2(presentation) X 2(instruction) ANOVA. The main effect for type of presentation ($F = 6.32$, $df = 1/72$, $p < .01$) was significant. Presentation of the categorizable lists in a blocked manner significantly increased clustering scores (Mean = .53) in comparison to a random presentation of the items (Mean = .33). The main effect of instruction ($F = 3.50$, $df = 1/72$, $p < .06$) approached significance. Receiving instructions as to the nature of the list also resulted in higher clustering. The mean clustering score for those receiving instructions was .51 and .36 for those receiving no instructions. The main effect for cognitive style was nonsignificant and the style X instruction interaction failed to reach significance.

Recall scores were analyzed in a 2(cognitive tempo) X 2(presentation) X 2(instruction) X 2(recall scores) ANOVA, with repeated measures on the last factor. A significant between main effect for type of list presentation was found ($F = 3.74$, $df = 1/72$, $p < .05$), with blocked presentation, facilitating total recall more than random presentation. The means for blocked and random presentation were 13.41 and 12.13, respectively. The style X instruction interaction was significant ($F = 4.99$, $df = 1/72$, $p < .02$). As can be observed in Figure 1, impulsives increased their recall performance

when given instructions as to the nature of the list, however the reflectives' performance decreased when given instruction. Main effects for cognitive

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Insert Figure 1 about here
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tempo (reflection-impulsivity) and for instruction were not significant. The within group main effect for free and cued recall showed that subjects were significantly better ($F = 67.12$, $df = 1/72$, $p < .01$) at recall under cuing conditions (Mean = 13.94) than when asked for free recall of items (Mean = 11.60). Also, the instruction X recall interaction was significant

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($F = 4.99$, $df = 1/72$, $p < .02$). A Newman-Keuls comparison among means was calculated and results indicated that cued recall under conditions of instructions was significantly ($p < .05$) better than cued recall with no instructions. Free recall scores did not differ significantly.

A correlation matrix was computed for the following variables, tempo, free recall, cued recall, clustering, latency for free recall, total viewing time, and IQ. Reflection-impulsivity was not significantly correlated with any variables.

DISCUSSION

Present results show that hierarchical organization (clustering) was enhanced by both blocking and instructions, Differences in clustering performance for groups presented with blocked and random lists, and for groups given instructions as opposed to no instructions indicate that experimenter-imposed structure was influential in the use of a hierarchical organizational strategy. Blocking the items appears to assist subjects in imposing an organizational structure and thus facilitates clustering.

Without having to search for and produce a strategy of organization on their own, subjects presented with blocks of items from specific categories organized them more effectively than subjects presented items in a random order. Instructions indicating that the list was categorizable and that this knowledge could aid recall, also were effective in increasing clustering performance. This suggests that increased structuring of the task (i.e. blocking or instructions) in such a way that the clusterizability is emphasized, increases the use of a hierarchical organizational strategy and that this ability is not differentially influenced by a personality characteristic such as cognitive tempo.

This study also lends support to previous finding (Laurence, 1967), that retention as measured by free recall is better when items from the same category are presented consecutively (blocked) than when presented randomly. However, while instructions were a significant variables in promoting clustering as a hierarchical organizational process, a differential effect was found in terms of product (words recalled). When collapsing across free and cued recall performance, the presence or absence of instruction interacted disordinally with cognitive tempo. While instructions improved recall significantly ($p < .05$) for impulsives, there was a deleterious effect on the recall performance of reflectives. A possible interpretation of the results would be that strategies employed by reflectives as they enter a learning task are hindered or interfered with by the experimenter-imposed instructions if the strategies do not coincide. An analytic nature, if characteristic of reflectives, could reflect several subjective organizational strategies of which clustering is only one. Because reflectives focus less globally on learning tasks, picking up more information about each item (Sigelman, 1969; Drake, 1970), a variety of strategies could possibly

arise. This would yield better free recall under conditions permitting the use of one's own strategies (non-instructed situation) and poorer recall when an experimenter defined strategy is required. The fact that the cognitive tempo X instruction interaction was not significant when analyzing clustering scores would support the idea that clustering as a process was utilized to an equal extent by all children under both instructional conditions, with only free recall (product) being effected.

Results also indicate that impulsives do enter the learning tasks with the ability to cluster and are aided significantly by instructions. This suggests that impulsives, may be deficient in using subjective organizational strategies and when given instructions to organize hierarchically recall is not hampered but can only improve.

Cued recall was superior to free recall. This is in agreement with recent findings by Eysenck and Baron (1974) who suggest that a retrieval deficit is central to the problem of item recall rather than storage difficulties limiting output. Items are stored in memory during learning, yet cues are needed to obtain the best recall. If the cues given during recall correspond to the manner in which items are stored, performance will be enhanced (Kintsch, 1970). Items in the present study were subsumed under superordinate category labels, thus presentation of the labels during recall allowed for increased accessibility of items within the categories.

Additional evidence concerning the retrieval deficit hypothesis is found in the significant interaction found between instructions and type of recall. Free recall was no better when instructions were given than when they were omitted. However cued recall was better under instructed conditions than non-instructed conditions. It appears that subjects utilized the instructions and stored more words as well as more retrieval cues

(category labels) with the information presented, but in free recall of the items, a problem arose in retrieving the items from storage. Without a cue, recall in the instructed condition was as low as in non-instructed conditions, however, when the appropriate cue was given, the greater number of items initially stored under the instructed condition were retrieved. While this finding corroborates the retrieval deficit hypothesis postulated by Eysenck and Baron (1974), it extends our understanding of the phenomenon in young children. Not only is a retrieval deficit present in the absence of instruction prior to storage (i.e., Eysenck and Baron, 1974), but in the presence of instructions as well. Also, since the sample in the present study was on the average three years older than Eysenck and Baron's subjects, it appears that a retrieval deficit is operative at the fourth and fifth grade level of development.

In summary, cognitive tempo as a personality characteristic was found to be of significance only in terms of memory processing in the presence or absence of instructions. Reflectives' hierarchical organizational ability was superior to impulsives in the absence of instructions and inferior in the presence of instructions. The presence or absence of instructions also has implications for the retrieval deficit hypothesis. The deficit is present in fourth and fifth graders under both conditions and most pronounced in the instructional condition. This would indicate that while introducing additional structure in a learning task via instructions enhances the storage of items, this gain is not automatically available in the retrieval phase for fourth and fifth graders.

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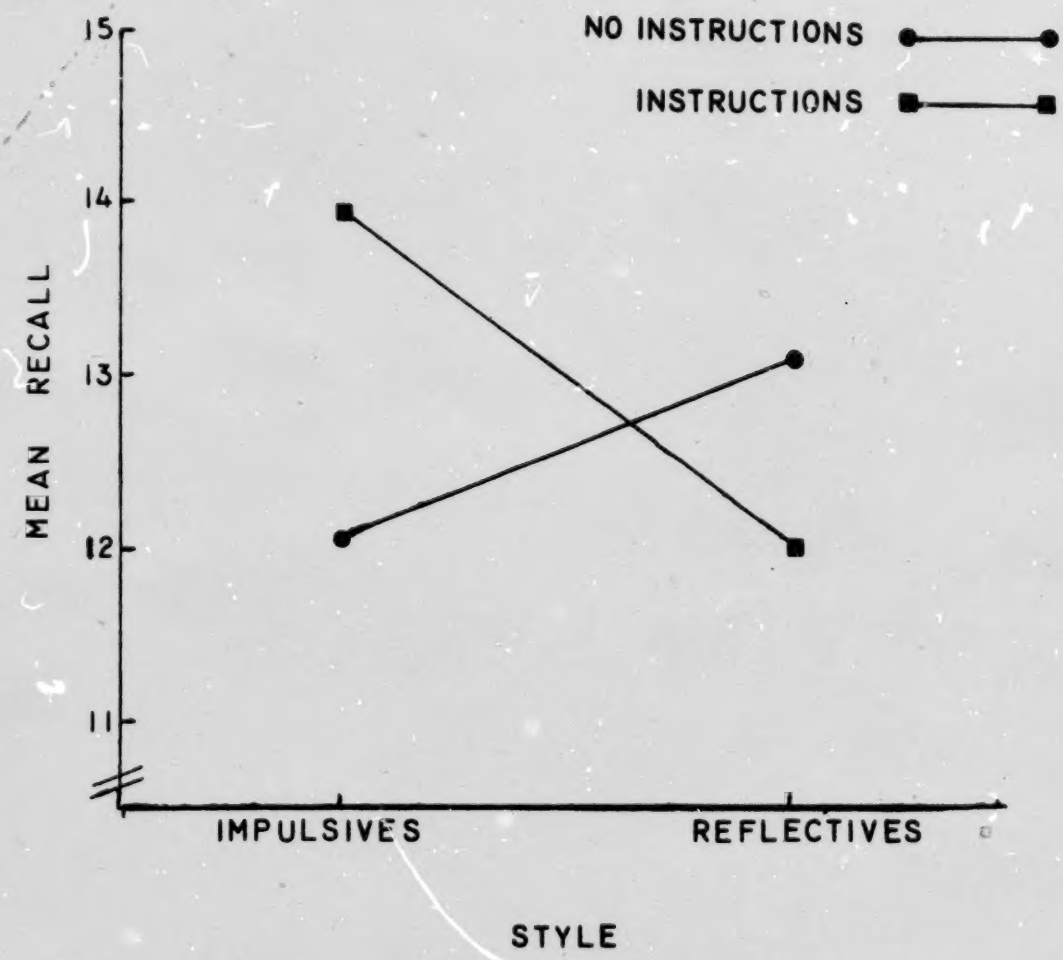
Figure Captions

Figure 1. Instructions X Cognitive tempo interaction.

Figure 2. Instructions X type of recall interaction.

Figure 1


NO INSTRUCTIONS
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MEAN RECALL
IMPULSIVES
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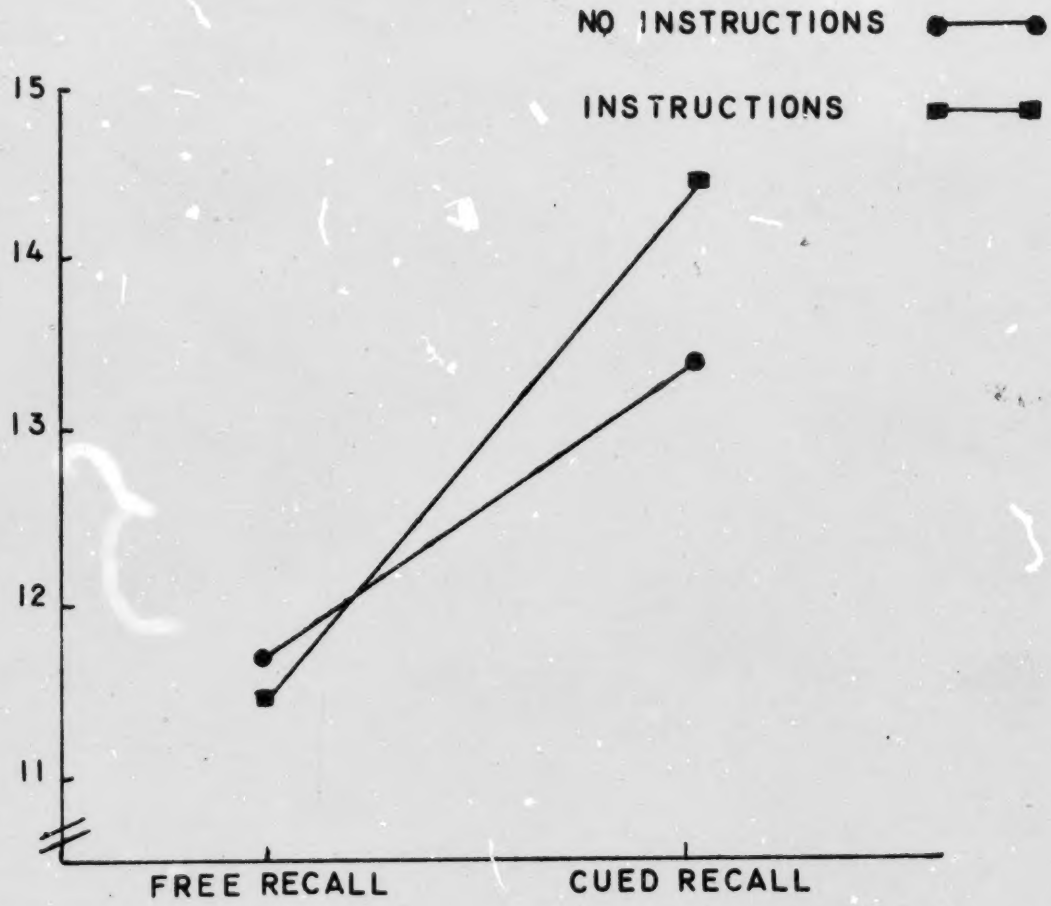
Figure 2


NO INSTRUCTIONS
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